ADMENDMENT OF THE CLAIMS

CURRENTLY AMENDED CLAIM WITH MARKINGS TO INDICATE CHANGES

Claim 1. (Currently Amended) What I claim as my invention is a method of bending elongate material that utilizes a pure bending moment created by applying through non-slip contacts a pair of torque couples of equal magnitude that are evenly rotationally displaced at equal rates in opposite directions simultaneously while, at the same time, being displaced linearly toward each other as the elongate material deforms, such that a pure bending moment is maintained throughout the duration of the bending process by accommodating the changing geometry of the deforming elongate material

CLAIM LISTING

Claim 1. (Currently Amended) What I claim as my invention is a method of bending elongate material that utilizes a pure bending moment created by applying through non-slip contacts a pair of torque couples of equal magnitude that are evenly rotationally displaced at equal rates in opposite directions simultaneously while, at the same time, being displaced linearly toward each other as the elongate material deforms, such that a pure bending moment is maintained throughout the duration of the bending process by accommodating the changing geometry of the deforming elongate material

Claim 2. (Original) The method of claim 1 wherein the elongate material bends only as a result of the pure bending moment, and no other stresses are present that cause deformation, such that there is a minimum of stress concentrations in the elongate material caused by the bending process.

Claim 3. (Withdrawn) I claim as my invention a computer controlled elongate bender machine that utilizes the method proposed in claim 1 with an embodiment consisting of a stationary bender assembly affixed to a support rail and a rolling bender assembly that rolls along the same support rail with each bender assembly consisting of a gearmotor coupled to a gearbox coupled to a low contact stress material interface that transfers torque to the elongate material in the form of torque couples arranged such that the two couples create a pure bending moment in the elongate material over the bending section.

Claim 4. (Withdrawn) The machine of clai,3 wherein the rolling assembly is displaced linearly along the support rail toward the stationary bender assembly during the bending process such that the material interface assemblies are positioned such that the couples continue to produce a pure bending moment in the bending section of the elongate material throughout the bending process, the rolling bender assembly locating linearly closer toward the stationary bender during the bending process to accommodate the changing geometry of the bending section of the elongate material.

Claim 5. (Withdrawn) The machine of claim 3 wherein an operator desiring a specific bend uses a digital interface to communicate with a computer control program that uses geometry and plasticity theory calculations and references a database of correction factors specific to specific elongate materials to determine the bend formula for the desired bend and then, through the control circuitry, controls the rotational displacement of the two gearmotors of the elongate material bender machine while observing the linear displacement between the rolling bender assembly and the stationary bender assembly as well as the rotational position of the material interfaces and after the rotational displacement of the material interfaces is completed, the material interfaces are rotated back in the opposite direction, or backed off, until the elastic rebound of the elongate material is released and then the control program evaluates the performance of the bend formula and updates the correction factor database if necessary.

Claim 6. (Withdrawn) The machine of claim 3 wherein the material interface assemblies are designed specifically for each application such that the contact stresses between the elongate material and the material interface assembly are less than the yield strength of the elongate

material, such that surface deformations and additional stress concentrations within the elongate material can be avoided.

Claim 7. (Withdrawn) The machine of claim 3 wherein the rotational displacement of both of the material interface assemblies of is equal in magnitude and rate at all times and occur simultaneously as the linear displacement between them such that the elongate material is allowed to freely bend in response to, and only to, the applied pure bending moment.

THE PATENTABLE NOVELTY THAT THE CLAIMS PRESENT

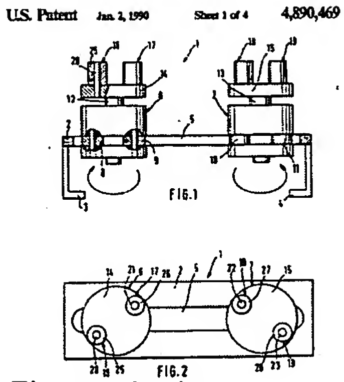
The claims of the present application have patentable novelty that distinguishes them from the references and the state of the art. The claims of the present application set forth a method for bending elongate material with a pure bending moment while maintaining that pure bending moment throughout the bending process by accommodating the changing geometry of the deforming elongate material. Some of the references use bending moments, but they do not use pure bending moments in the absence of shear stresses. The references do not maintain a pure bending moment throughout the bending process by accommodating the changing geometry of the deforming elongate material. None of the references expressly disclose each and every element of the claims of the present application. The claims of the present application go a step beyond the state of the art.

RESPONSE TO DISCHLER (4,890,469)

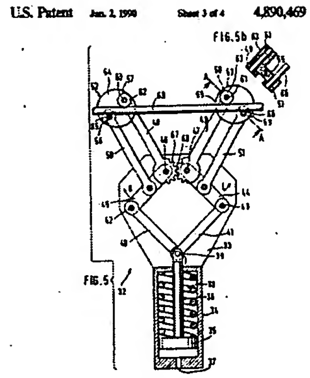
Dischler (4,890,469) discloses bending machine configurations that do not utilize the method claimed in the present application. The Examiner referred to the

> "embodiment of figures 1-4 where the rotary disks or torque couples 14 and 15 are rotated simultaneously in opposite directions to apply a bending torque while also *decreasing* the distance between the rotary disk or torque couples in a *linear* fashion. The *linear movement* of the torque couples is limited to the linear slot 5, which *guides the torque couples towards one another during the bending operation*" (emphasis added, Office Action).

Dischler did not anticipate, teach, or claim this method. Dischler described three mechanisms. The first mechanism is pictured below and is the one referred to by the Examiner consisting of two bending force transmitting bending devices and a base with a slot. The second mechanism is pictured below and consists of two bending force transmitting devices located by a powered four bar linkage. While Dischler's first mechanism did have a linear slot, the slot was for adjustment



First mechanism



Second mechanism

of the bending radius prior to the bending operation, and not for the moving of the bending torque couples toward each other during the bending operation.

DISCHLER'S FIRST MECHANISM

In the "Background of the Invention" Dischler states that "the spacing between the bending devices is also *adjustable* so that bending can be carried out at mutually different spacings" (emphasis added, Dischler). Dischler further states that the radius of the bend depends "on the *spacing* of the bending devices at the beginning of the bending procedure. The *larger this separation*, the greater the bending radius" (emphasis added, Dischler). Dischler further states that if the first mechanism is to be used to always make the same bending radii, "then it suffices to keep the bending devices at a fixed distance apart" (Dischler). Dischler further describes the slot as a device to adjust the radius of the bend prior to the bending operation by stating that if different bending radii are desired, that "this can be achieved on one hand in that the bending devices are *fixed in place* at diverse spacings" (emphasis added, Dischler). These would be discreet locations that the bending devices would be fixed at corresponding to discreet spacings between the bending devices and also corresponding to discreet bending radii. If more adjustment is desired so that all of the spacings between the longest and shortest possible spacing

between the bending devices could be set, Dischler states that "alternatively at least one of the two bending devices, but especially both, shall be *guided* freely" (emphasis added, Dischler). Dischler again describes the slot by stating that "the bending device(s) shall be displaceably *mounted* in a slot *guide*" (emphasis added, Dischler).

The explanation of the first mechanism states that the bending components ~~no~~ of the bending devices are rollers and that the "rollers 25, 26 and 27, 28 pivot about the shafts 20, 21 and 22, 23 respectively" (Dischler). The rollers "allowing a corresponding escape slippage of the wire" (Dischler).

ERRORS IN DISCHLER'S FIRST MECHANISM

The first mechanism that Dischler describes does not use the method of the present application. The present application uses a continuously pure bending moment throughout the plastic deformation of the elongate material. The first mechanism employs bending components each with a "freely rotating sleeve" (Dischler) so that "the length may slip through the bending components while being bent" (Dischler). If the material slides through the bending components during the bending operation, then the bending forces are not being applied normal to the axis of the elongate material or there is some other force present that moves the material through the bending components. Thus shear forces are present and this is not a pure bending moment. Dischler falsely describes the bending forces as follows:

> "the length of extruded material will be curved in opposite direction at two mutually spaced sites and simultaneously about two mutually parallel axes which are transverse to the longitudinal axis of the extruded length, essentially *without other substantial forces*. In this manner the length to be bent is subjected to a curving or bending moment acting transversely to the longitudinal axis of this length, and this is done by a pair of forces applied at two spaced sites. Due to the application of such a bending torque, the length

> then bends freely and *uniformly* in the space between the two bending devices" (emphasis added, Dischler).

Dischler also states that :

> "In the first cited solution, the length to be bent is *kept free from any additional forces* by the roller-shaped design of the bending components *because the length may slip through the bending components* while being bent" (emphasis added, Dischler).

If the material is slipping longitudinally through the bending devices, then there have to be other substantial forces present, and the bending forces will not be applied evenly to the elongate material, but some areas will be worked before others, and the resultant bent elongate material should manifest differing bending radii.

Dischler also stated that "it may be appropriate that one bending component of each bending device be located in the pivot axis and therefore act only as a bearing. In that case only one of the bending components will be moved transversely to the lengths being bent" (Dischler), which would not transmit a pure bending moment, but would also transmit shear forces to the elongate material.

Due to the errors cited above, including roller bending components and asymmetrical positioning of bending components, Dischler erred further when he stated that:

> "the spacing between the two bending devices can be set automatically in such a manner that *only bending torques but no further forces are transmitted* to the lengths to be bent. As a result a *neat arc of circle* shall be achieved, provided that the material involved is uniform in its moment of inertia with respect to length" (emphasis added, Dischler).

The bend resulting from elongate material slipping through the bending components during the bending process will have a parabolic shape with a smaller bending radius in the middle of the

elongate material and larger bending radii toward the edges of the bend, some approximation of a V.

In the explanation of the drawings Dischler states that the first mechanism's "two bending devices 6, 7 are guided in easily displaceable but *irrational* manner" (emphasis added, Dischler), which the Applicant does not find explanatory. Dischler further states that there are rollers within the slot "of which the diameter corresponds to the width of the slot" (Dischler), which the Applicant notes that if the rollers and slot were the same diameter that the rollers would have difficulty rolling or sliding within the slot.

DISCHLER'S SECOND MECHANISM

The second mechanism that Dischler described utilized bending torques that approached each other during the bending operation in a forcible and controlled manner, not in the simple free bending manner of the present application. Dischler stated:

> "as regards the last cited solution, no relative motion between the length and the bending components takes place because the bending devices are guided in such a manner that their spacing decreases in relation to the progress in bending" (Dischler).

This is accomplished through a powered four bar linkage mechanism. Dischler further describes the motions and spacings of the bending components of the second mechanism by stating that "the spacing between the two bending devices can be set automatically" (Dischler). Dischler also describes the second mechanism by stating that "special constrained guide means may be provided, which cause the change in separation required to apply the bending torque" (Dischler). without further explanation of the method of varying the separation, but describing the

mechanism in generic terms as various links and four joint kinematics. Dischler describes the second mechanism by stating that

> "a simple design is given when the guide links are hinged to the bending devices at the shafts of the bending component," and that "in order that the guide links and hence the bending devices always be mounted with mirror-symmetry to each other, one guide link of one bending device shall be synchronized by a gear unit with a guide link of the other bending device. This can be implemented in simple manner by two mutually meshing gears or gear sectors. The gear transmission will be especially simple if one of the guide links rests in the pivot axis of the associated four-joint kinematics so that its hinge point performs only a motion of rotation" (Dischler).

This would not impart a pure bending torque. Shear forces would be present since the reduction of the spacing is forced and would not be able accommodate the changing geometry of the elongate material as it deformed, and thus it would not be a free bending process resulting solely from a pure bending moment. Dischler's second mechanism can only create one radius size of a bend since the angle of rotation of the bending devices is directly and fixedly correlated to the reduction of the space between the bending devices. The linkage sizes would have to be changed to permit another radius size of bend. The Applicant also notes that the gear synchronization appears to be redundant in Dischler's second mechanism, since the bending devices and components are already synchronized due to the design of the linkage system.

In the explanation of the drawings of the second mechanism Dischler states that:

> "The desired bending radius is determined by the spacing between the two bending devices 52, 53 at the beginning of bending. The larger the spacing, the larger too the bending radius that will materialize.
>
> This manual bending machine 32 therefore allows shaping wires with the desired bending radius and angle without thereby having to modify the machine 32 itself at all" (Dischler).

This statement is an error as the Applicant described above. The angle of rotation of the bending devices and the spacing between them is directly and fixedly correlated, and to change to a

different bending radius requires changing the lengths of the linkages.

DISCHLER'S THIRD MECHANISM

Dischler describer a third mechanism wherein hydraulic or pneumatic pistons are used to apply bending forces to the elongate material. These forces do not maintain a pure bending moment throughout the bending of the elongate material since the forces will not intersect normal to the material once the material geometry starts to deform during the bending process.

DISCHLER'S CLAIMS

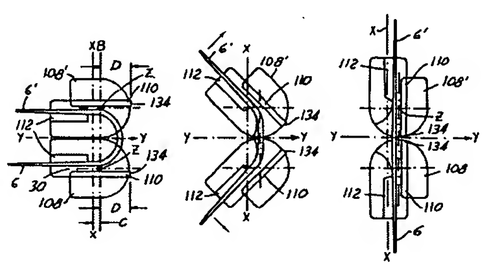
Dischler claims the roller contacts as his invention in claim 1 by stating "bending components and thereby impress first and second torques on the length while permitting the length to move relative to the engaged rotatable bending components" (Dischler). Roller contacts would detract from the present application and the present application makes no claim to roller contacts. Dischler makes no claim to applying a bending moment, pure or otherwise, to the elongate material. Dischler makes no claim to utilizing torque couples that approach each other as they rotate. Dischler makes no claim that the final bent elongate material has a minimum of stress concentrations caused by the bending process.

The claims of the present application were not anticipated by the mechanism of Dischler (4,890,469). Dischler's mechanism as claimed did not perform the same functions of the present application. Although Dischler's description was much broader than his claims, his description contained many errors and false statements and would have to be significantly modified to carry out the functions of the present application.

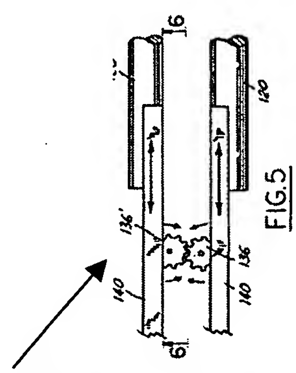
RESPOSE TO STEPANENKO (6,173,599)

The Examiner did not specifically refer to Stepanenko (6,173,599) in the Rejections section of the Office response, but the Examiner did list Stepanenko in the Notice of References Cited. Stepanenko discloses "an apparatus for straightening a U-shaped leaf spring" (Stepanenko). Stepanenko did not anticipate, teach, or claim the method of the present application.

Stepanenko described two similar versions of a mechanism for straightening U-shaped leaf springs. The mechanism has "a plurality of pivotal block members which simultaneously rotate counter to one another" (Stepanenko) to unbend the springs. The method of bending is shown below. The pivotal bending block "members 108 and 108[prime] are



Step 1 Step 2 Step 3
Method of bending.



Bending devices are synchronized by gears meshing.

rotated in unison in opposite directions by means of the rack and pinion arrangement" (Stepanenko), and "the rotation of the block members 108 and 108[prime] will be synchronized by the meshing of the pinion gears 136 and 136[prime]" (Stepanenko). The pivotal blocks maintain their axis of rotation throughout the straightening process, without approaching each other and without moving away from each other, which is not a pure bending moment but one

that involves shear stresses. Stepanenko also states that the apparatus is "for straightening a heated folded leaf spring" (Stepanenko). The present application did not claim straightening or heated bending.

STEPANENKO'S CLAIMS

Stepanenko claims a "ram to support the curved section of the leaf spring" (Stepanenko), which is not free bending but is bending that involves shear stresses, and not a pure bending moment. The present application does not claim a ram for bending, but claims free bending as a result of a pure bending moment. It is clear that Stepanenko teaches a method of straightening that involves forcing the work piece with walls and a ram to form the desired end result, this process involves shear stresses, uneven bending, and stress concentrations. Stepanenko did not teach a method that involves bending torque couples moving in relation to each other to maintain a pure bending moment throughout the geometrical deformation of the work piece.

Stepanenko makes no claim to applying a bending moment, pure or otherwise, to the elongate material. Stepanenko makes no claim to utilizing torque couples that approach each other as they rotate. Stepanenko makes no claim that the final bent elongate material has a minimum of stress concentrations caused by the bending process.

The claims of the present application were not anticipated by the mechanism of Stepanenko (6,173,599). Stepanenko's mechanism as claimed did not perform the same functions of the present application. Stepanenko's mechanism could not be modified to carry out the functions of the present application.

RESPOSE TO BROGREN (2,565,717)

The Examiner did not specifically refer to Brogren (2,565,717) in the Rejections section of the Office response, but the Examiner did list Brogren in the Notice of References Cited. Brogren discloses an apparatus for tube bending "which requires a minimum amount of space in the shop" (Brogren). Brogren did not anticipate, teach, or claim the method of the present application.

Brogren described the invention by stating:

> "In this invention the tube is *wrapped* about a *forming roll* or accurate part which rotates about a center which center is advanced parallel to the tube. The forming- roll revolves along-a path parallel to the tube as the *roll rotates*, More particularly an important feature of the apparatus is that it includes *means for supporting a tube* in part along, a pathway over which; a *forming roll or disc* -is supported for rotatable of the supported tube to the roll, *to wrap about the periphery thereof as the roll revolves along*, the pathway thereby *imparting a permanent bend* to the tube" (emphasis added, Brogren).

This method uses a roll and forcibly pulls the elongate material along the curved surface of the roll to bend the elongate material. The roll applies stresses normal to the axis of the elongate material and thus applies shear stress to the elongate material and does not use a pure bending moment to bend the elongate material. The present application does not claim using a roll to bend elongate material and does not claim using shear stresses to bend elongate material, but does claim using a pure bending moment.

BROGREN'S CLAIMS

Brogren claims a "gear to rotate therewith, means for clamping opposite end portions of a tube to said tube forming parts to wrap thereabout as the parts revolve with the gears" (Brogren).

Brogen also claims “a tube forming roll” and “said roll having a grooved accurate tube forming face” and “means for advancing the roll revolvably lengthwise of the block supported projecting end of tubing to wrap the tubing about the roll” (Brogren).

Brogren did not teach a method that involves bending torque couples moving in relation to each other to maintain a pure bending moment throughout the geometrical deformation of the work piece.

Brogren makes no claim to applying a bending moment, pure or otherwise, to the elongate material. Brogren makes no claim to utilizing torque couples that approach each other as they rotate. Brogren makes no claim that the final bent elongate material has a minimum of stress concentrations caused by the bending process.

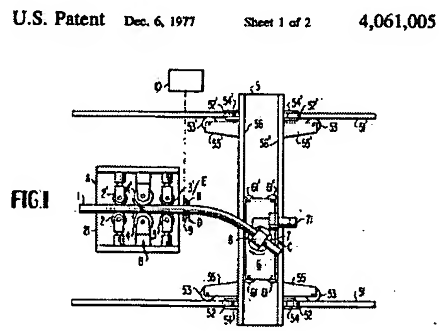
The claims of the present application were not anticipated by the mechanism of Brogren (2,565,717). Brogren’s mechanism as claimed did not perform the same functions of the present application. Brogren’s mechanism could not be modified to carry out the functions of the present application.

RESPOSE TO KAWANAMI (4,061,005)

The Examiner did not specifically refer to Kawanami (4,061,005) in the Rejections section of the Office response, but the Examiner did list Kawanami in the Notice of References Cited. Kawanami discloses “A method of continuously bending elongated materials” comprising of “a guiding means and clamping a second portion” and a “heated zone bounded by a cooled

zone" and "a compressing means" (Kawanami). Kawanami did not anticipate, teach, or claim the method of the present application.

Kawanami claims a method of bending and describes an apparatus to use that method. The method comprises of pushing elongate material into a narrow heated zone to soften the material where it is also subject to bending forces and deformed and then cooled. A drawing of the apparatus is located below. Kawanami taught a method for localized bending using heat,



An embodiment of Kawanami.

bending moments, and shear forces. The Applicant claims a method for bending across the length of the elongate material utilizing a pure bending moment in the absence of shear forces.

Kawanami states that the mechanism has a:

> "clamping means capable of imparting a moment [through rotational displacement of the clamp] to the material… and at the same time capable of moving freely in a horizontal plane; rotating said clamping means through a desired angle at a desired speed thereby imparting a simple, *pure bending moment* to said material" (emphasis added, Kawanami).

This is an incorrect statement. Kawanami does use a bending moment, but Kawanami does not use a pure bending moment in the absence of any shear forces. Kawanami creates a narrow localized area in which the bending of the elongate material takes place. This localized area has a heating zone for softening the elongate material, which is the only place bending will

take place since this is the weakest location in the elongate material. The bending forces are created by the rotation of the clamp on the elongate material. The clamp is located progressively further away from the narrow heated bending zone during the bending process. Since the elongate material between the narrow heated bending zone and the clamp is cooled and work hardened, it will not bend under the torque from the clamp, but will transfer those forces to the narrow heated bending zone and bend the elongate material in that zone. Once the elongate material transferring the bending forces has been bent, it will not transfer the bending forces normal to the axis of the elongate material in the narrow heated bending zone, and thus will not transfer a pure bending moment to the narrow heated bending zone. The method of pushing the elongate material through the narrow heated bending zone may also introduce compressive and shear stress deformations, but the method Kawanami describes of applying compression to the elongate material will also introduce compressive and shear deformations.

Kawanami states that the apparatus has "a guiding means for establishing a stationary point of engagement with the elongated material moving relative to said guide means; and movable bending means for engaging the elongated material imparting a moment to the material and at the same time capable of moving freely in a horizontal plane" (Kawanami). The guiding means is described as being rollers for the elongate material to push through. One of the rollers is a powered driven roller to be a "feeding means may be provided with which to drive the elongated material through said guide means" (Kawanami). Kawanami describes the narrow heated bending zone as "a limited narrow zone in which plastic deformation for bending should occur" (Kawanami). Directly after the narrow heated bending zone there is a cooling zone "to cool the elongated material at a forward edge of a heated zone in which plastic deformation of

the heated zone has been completed" (Kawanami). Kawanami also states that the apparatus has "an additional compressing means to give the elongated material compressive stress" (Kawanami) during the bending process.

Kawanami's method creates excess stress concentrations by utilizing localized deformation and shear stresses. The forces that the guide rollers will impart to the elongate material will be primarily reaction forces in response to the bending torque applied to the elongate material from the clamp. These reaction forces of the guide rollers will act primarily as shear stress on the narrow heated bending zone.

Kawanami states that he assumes "there is no compression, tension, nor shearing of the elongated material at the heated zone which is between unbent and bent portions of the elongated material" and "that there can exist only a pure bending moment at the heated zone" (Kawanami). These are incorrect statements. Due to the arrangement of parts in the apparatus, there will be shear stresses on the narrow bending zone and there will be compressive stresses on the narrow bending zone. The manner in which the elongate material is bent in only a narrow heated zone of softened material and that the bending forces are transferred to that narrow heated bending zone through bent elongate material of varying geometry and elastic deflection focuses the bending forces on that ~~the~~ narrow heated bending zone and creates shear stresses. The present application avoids these problems by bending across the entire elongate material bending section at the same time, rather than localized bending.

Kawanami describes the methods that the invention applies compression to the narrow heated bending zone. The "first consists of controlling temperature distribution around the heated zone keeping larger radius side of the elongated material cooler than smaller radius side" and the "second consists of applying a compressive force along the axis of the pipe or elongated material" (Kawanami). One way Kawanami describes of applying the compressive force is with a wire rope tensioned with a hydraulic cylinder which Kawanami admits "may give some amount of harmful bending moment" (Kawanami). The other way that Kawanami describes of applying the compressive force is with a chain with protrusions for transferring force to the walls of a tube or pipe that will "exert not only compressive force along the axis… but may also exert a force perpendicular to the principle axis of pipe" (Kawanami), which is shear stress. A pure bending moment deforms symmetrical material with tension across half of the area of the cross section and compression across the other half of the area of the cross section, with equal amounts of compression and tension. The compression applied to the narrow heated bending zone will make the compressed area of the cross section greater than the tensioned area, creating an impure bending moment and shear stresses in the narrow heated bending zone. The present application avoids these problems by avoiding compressive forces and shear stresses.

Kawanami states that "the elastic curve of the bent portion of pipe 1 remains circular" (Kawanami) during the bending process. This does not describe a pure bending moment. The elastic deformation of a beam due to a pure bending moment is parabolic and not circular.

KAWANAMI'S CLAIMS

Kawanami claims a method and apparatus for advancing and guiding elongate material, a rotating clamping portion to apply a bending torque to the elongate material, the clamping portion being displaceable within the plane of bending, a heating portion, and a cooling portion. Kawanami claims that the plastic deformation of the elongate material occurs in the heated zone. Kawanami claims a method of applying compressive stress and radial stress to the elongate material.

Heating and cooling means and means for applying compressive and radial stresses to the elongate material would detract from the present application, and the present application makes no claim of these things. Advancing the elongate material during the bending process would detract from the present application, and the present application makes no claim of this thing. Kawanami makes no claim to applying a bending moment, pure or otherwise, to the elongate material. Kawanami makes no claim to utilizing torque couples that approach each other as they rotate. Kawanami makes no claim that shear stresses are minimized or avoided. Kawanami makes no claim that the final bent elongate material has a minimum of stress concentrations caused by the bending process.

The claims of the present application were not anticipated by the method and mechanism of Kawanami (4,061,005). Kawanami's method and mechanism as claimed did not perform the same functions of the present application. Kawanami's description contained many errors and false statements. Kawanami's method and mechanism would have to be significantly modified to carry out the functions of the present application.

Kawanami's method also is very complex in that there are many variables that can affect the bending angle and bending radius. The rate of heating and the rate of cooling both affect the bending angle and bending radius. The rate of the rotational displacement affects the bending angle and bending radius. The rate of the drive feeding means and the length of the elongate material between the narrow heated bending zone also affect the bending angle and the bending radius. The further displaced the clamp is from the narrow heated bending zone, the greater the required amount of angular deflection required to impart the same bending force displacement due to the increasing elastic deflection of the lengthening elongate material. Increasing torque will also be required the further the clamp is displaced from the localized heated bending zone to impart the same bending forces on the narrow heated bending zone. Kawanami also describes a method forcibly locating the bending clamp with a powered screw drive, which is more complicated than the claimed method of the present application.

RESPOSE TO REIGL ((DE) 4,432,041)

The Examiner did not specifically refer to Reigl ((DE) 4,432,041) in the Rejections section of the Office response, but the Examiner did list Reigl in the Notice of References Cited. Reigl did not anticipate, teach, or claim the method of the present application. Reigl discloses a "process for coplanar free bending of tubes, bars or similar" comprising of forming curves in elongate material "by *displacing* and rotating its ends" (emphasis added, Reigl), which are held in clamps. Reigl states that "the *applied forces*, couples and bending moments generate a region of plastic flow in the work piece at the position of the largest positive bending moment, and also at the position of the smallest negative bending moment" (emphasis added, Reigl), causing an S

bend. Reigl states that the "*movements* of the clamps are *controlled* by computer" (emphasis added, Reigl). Reigl uses a forcibly controlled method to locate the position of the clamps by applying forces to the clamps. This is not a pure bending moment. The forces create shear stresses in the elongate material. The present application does not use forces to locate the clamps, but the clamps are located automatically to accommodate the changing geometry of the bending elongate material and to allow the elongate material to bend freely. The present application also utilizes a continuously pure bending moment. The present application is directed toward making only one bend at a time, whereas Reigl's process makes an S bend, which is two opposite bends at one time.

Displacing the clamps with forces would detract from the present application, and the present application makes no claim of this. Using bending moments with the same direction would detract from the present application, and the present application makes no claim of this. Reigl makes no claim to applying a pure bending moment. Reigl makes no claim to utilizing torque couples that approach each other as they rotate oppositely. Reigl makes no claim that shear stresses are minimized or avoided. Reigl makes no claim that the final bent elongate material has a minimum of stress concentrations caused by the bending process.

The claims of the present application were not anticipated by the method and mechanism of Reigl ((DE) 4,432,041). Reigl's method and mechanism as claimed did not perform the same functions of the present application. Reigl's method and mechanism would have to be significantly modified to carry out the functions of the present application. Reigl's method also

is very complex in that there are more parts, more axis of motion, and more forces involved than the claimed method of the present application.

DECLARATION

Pursuant to 37 CFR 1.68 the Applicant, Vincent Craig Olsen, having been warned that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon, declares upon his honor that all statements made within this Reply document are of the Applicant's own knowledge and are true and that all statements made on information and belief are believed to be true.

Vincent Craig Olsen

Signed this 1st day of March 2007

CERTIFICATE OF MAILING

I, Vincent Craig Olsen, do HEREBY CERTIFY that on the 1st day of March, 2007, I mailed a true and correct copy of this Reply document by placing said document in a first class postage paid envelope and depositing such into the U.S. Mail system addressed to:

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Vincent Craig Olsen